

value their classmates' contributions and strive to make their own contributions of value to others. The class as a whole develops an understanding about values held by mathematicians and scientists all over the world: precision, clarity, intellectual honesty, effort, and thoroughness. But to accomplish this takes effort, planning, and many months of work.

The Tools of Classroom Talk

As teachers, we elicit responses from our students in various ways—with questions, commands, hints, jokes, and so on. When students become familiar with our inventory of phrases and expressions, they usually know what we expect of them. Although we rarely stop to think about our most common conversational prompts, they are among our most important instructional tools. From our work in Project Challenge, we have found it useful to think carefully about these tools: it matters what you say and how you say it.

In this chapter we present a number of examples of talk in action in mathematics lessons and describe the tools that teachers use to implement classroom talk. The tools include strategies—what we call “talk moves”—that support mathematical thinking, talk formats that provide different ways to organize students for conversation, and ideas for creating a classroom where respect and equal access to participation are valued norms. Narrative examples, or cases, illustrate how the basic tools of talk look in action in four different classrooms.

Five Productive Talk Moves

In this section we introduce five talk moves that we return to repeatedly throughout the book. Each move is a suggested action that we have found to be effective for making progress toward achieving our instructional goal of supporting mathematical thinking and learning. For each, we describe the move, give a brief classroom example to illustrate it, and then explain the teacher action required. Each move serves various purposes, and we describe some of those purposes in this chapter. However, you will discover other purposes for the moves in later chapters, and you may even discover some new

purposes as you implement these moves in your own classroom. (It's important to note that these five moves are not the only ones that teachers can use to support productive mathematical talk. However, we focus here on these five as they provide a solid base on which to begin.)

Revoicing. ("So you're saying that it's an odd number?")

When students talk about mathematics, it's often very difficult to understand what they say. Even if their reasoning is sound, it may not appear sound when they try to put their thoughts into words. Sometimes it's impossible to tell whether what they have said makes sense at all. And if you as the teacher have trouble understanding it, there's not much hope that the student's classmates will do any better. Yet given your goals of improving the mathematical thinking of all students, you cannot give up on an especially unclear student. If the only students whose contributions are taken seriously are those who are easy to understand, few students will ever improve. Deep thinking and powerful reasoning do not always correlate with clear verbal expression.

Therefore, teachers need a talk move that can help them deal with the inevitable lack of clarity of many student contributions. They need a tool that will allow them to interact with the student in a way that will continue to involve that student in clarifying his or her own reasoning. And they need a tool that will help other students continue to follow along in the face of the confusion. One such tool has been called "revoicing." In a revoicing move, the teacher essentially tries to repeat some or all of what the student has said, and then asks the student to respond and verify whether or not the teacher's revoicing is correct, as in the dialogue below.

Ms. Davies has given her third graders a series of numbers, and in a whole-group discussion has asked them to say whether the numbers are even or odd. They have established that if you can divide a number by two evenly, then it is an even number. Philipe has tackled the number 24. His contribution is less than completely clear:

1. Philipe: Well, if we could use three, then it could go into that, but three is odd. So then if it was . . . but . . . three is even. I mean odd. So if it's odd, then it's not even.
2. Ms. D: OK, let me see if I understand. So you're saying that twenty-four is an odd number?
3. Philipe: Yeah. Because three goes into it, because twenty-four divided by three is eight.

After hearing Philipe's confusing contribution, all Ms. Davies could grasp was that Philipe *might* be saying that 24 is odd. She hazards a guess in the form of a revoicing move: "So you're saying that twenty-four is an odd number?" By phrasing this guess as a question, she is essentially asking Philipe if her understanding is correct. By using this move, she gives him a chance to clarify. As it works out, he shows that he did intend to claim that 24 is an odd number, and he gives his reason. By opening this conversational space for Philipe to respond, Ms. Davies has learned that he has a basic misconception about even and odd numbers. She has gained a foothold in the discussion that she did not have after simply hearing Philipe's first contribution.

While revoicing is especially useful in situations such as that described with Philipe, it's also an effective move when you understand what a student has said but aren't sure that the other students in the class understand. Revoicing can make one student's idea available to others, give them time to hear it again, position a student's claim with respect to a previous student's claim in order to create the basis for an ongoing discussion, or focus on a change that has occurred in the discussion. Revoicing provides more "thinking space" and can help all students track what is going on mathematically.

Asking students to restate someone else's reasoning.

("Can you repeat what he just said in your own words?")

In the example above, the revoicing move was used by the teacher. However, the teacher can also extend the move to students, by asking one student to repeat or rephrase what another student has said, and then immediately following up with the first student. Ms. Davies used this move to continue the classroom conversation.

4. Ms. D: Can anyone repeat what Philipe just said in his or her own words? Miranda?
5. Miranda: Um, I think I can. I think he said that twenty-four is odd, because it can be divided by three.
6. Ms. D: Is that right, Philipe? Is that what you said?
7. Philipe: Yes.

This move has several potential benefits. First, it gives the rest of the class another rendition of the first student's contribution. It gives them more time to process Philipe's statement, and adds to the likelihood that they will follow the conversation and understand his point. It thereby supports the teacher's

goal of giving all students full access to participation. This move is particularly valuable for students whose first language is not English. Second, this move provides evidence that the other students could and did hear what Philippe said. This is important: if students could not or did not hear what a speaker said, they cannot easily participate in further exchanges. Finally, it yet again clarifies the claim that Philippe is making and provides Philippe with evidence that his thinking is being taken seriously. Over time, as students come to realize that people are listening closely to what they say, they increasingly make efforts to make their contributions comprehensible.

Asking students to apply their own reasoning to someone else's reasoning.
 ("Do you agree or disagree and why?")

After a student has made a claim, and the teacher has made sure that students have heard it and have had time to process it, she can move on to elicit student reasoning about the claim. Ms. Davies employs this move to pursue the issue.

8. Ms. D: Miranda, do you agree or disagree with what Philippe said?
9. Miranda: Well, I sort of . . . like, I disagree?
10. Ms. D: Can you tell us why you disagree with what he said? What's your reasoning?
11. Miranda: Because I thought that we said yesterday that you could divide even numbers by two. And I think you can divide twenty-four by two. And it's twelve. So isn't that even?

By asking Miranda whether she agrees or disagrees with Philippe's claim and why, Ms. Davies is directing attention to Miranda's reasoning. Note that Ms. Davies has refrained from supporting one or the other position. At this point she is using talk moves to elicit respectful discussion of ideas. Later on, as students more fully understand the issues, Ms. Davies can make sure that they converge on the correct understanding of even numbers.

It's important to note that Ms. Davies does not simply ask whether Miranda agrees or disagrees but then follows up by asking her to explain why. As with the revoicing move, asking students to explain their reasoning is a key part of this move, and is critical in general to supporting students' mathematical learning. The point of this move is to cause students to make explicit their reasoning by applying their thinking to someone else's contribution. Therefore, she prompts Miranda to explain *why* she disagrees.

Prompting students for further participation.
 ("Would someone like to add on?")

At this point Ms. Davies increases participation in the discussion by asking for further commentary. First she uses the move of revoicing again as a way to clarify the two positions that have emerged, and to model how to talk respectfully to the originators of the two positions. Then she asks others to contribute, prompting them to either state agreement or disagreement, or to add other comments. This prompting for more input on previous statements will, over time, result in students showing more willingness to weigh in on what the group is considering.

12. Ms. D: So we have two different ideas here about the number twenty-four. Philippe, you're saying that twenty-four is odd because you can divide it by three?
13. Philippe: Uh-huh.
14. Ms. D: And Miranda, you're saying that it's even because you can divide it by two? Is that correct?
15. Miranda: Yes.
16. Ms. D: OK, so what about other people? Who would like to add to this discussion? Do you agree or disagree with Miranda's or Philippe's ideas? Tell us what you think, or add on other comments or insights.

Using wait time. ("Take your time . . . we'll wait . . .")

The final talk move we mention in this chapter is not actually speech at all, but silence! Many teachers are familiar with the important finding that after having asked a question, a teacher should wait at least ten seconds for students to think before calling on someone for an answer. Wait time also comes into play after a student has been called on. After a teacher has called on a particular student, that student should be given at least the same amount of time to organize his or her thoughts.

In the exchange above, after Ms. Davies has presented the class with a summary of Miranda's and Philippe's competing positions, and has asked for additional input, she waits . . . and waits . . . and waits. One or two students raise a hand immediately. Others look thoughtful, but don't volunteer. After five seconds, the students see that Ms. Davies is waiting for more responses. These students know that in their classroom it is not always the same super-fast two or three students who will answer all the questions. They know that Ms. Davies will wait until a number of them think through her question.

After fifteen or twenty seconds, slowly, other hands go up. After forty-five seconds, Ms. Davies finally calls on Eduardo. He is hesitant, and actually sits silent after she calls on him even though his hand has been raised. So again, Ms. Davies waits. Ten seconds go by. Finally, the student responds:

17. Eduardo: Yes, I agree with Miranda's idea, because the only way you told us to find out if something is even is to divide by two. And if we divide twenty-four by three, we can also divide it by four. And we can divide it by six, too. So I think we should stick with two only.

By waiting patiently, Ms. Davies has made it possible for Eduardo, a second-language learner, to make an important contribution that she and other students can build on in the ensuing discussion. But this move is not easy for her. Although the research is clear on the value of wait time, it is actually quite difficult to adopt consistently. We all tend to feel uncomfortable with silence, not wanting to put a student on the spot. Yet few students can speedily put together an answer to a complicated question about their own reasoning. So if we do not use wait time consistently and patiently, students give up and fail to participate, knowing that they cannot "beat the clock." In later chapters we again address this and related moves designed to give students the time they need to think and reason mathematically.

Three Productive Talk Formats

Along with thinking about talk moves that guide students' learning, it's also useful to consider the talk formats available to teachers. Talk formats are different ways that teachers configure classroom interaction for instruction. For example, Ms. Davies took advantage of all five talk moves and used the talk format of whole-class discussion, having her entire class participate together in mathematical thinking and reasoning. Every classroom teacher makes use of a variety of talk formats, and these formats are among the major tools that teachers use to accomplish their goals for student learning. Each format carries with it certain opportunities and certain limitations.

Each format has its own "rules for talk." Some of these rules are rarely discussed, but students know them, nevertheless. For example, in the traditional and familiar talk format that we might label *direct instruction* or, in the higher grades, *lecturing*, the rules go something like this: the teacher has the right to talk, and students must not talk unless the teacher calls out their name. *Quizzing* is another commonly used talk format in which the teacher asks